Operating and Service Manual

GOULD

Electronics & Electrical Products

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PRELIMINARY

This is a working document only, and does not represent any official intent on the part of Gould, Incorporated.

GOULD 2800S RECORDERS
INK WRITING MODELS
(OPTIONAL THERMAL ANNOTATION)
OPERATORS AND SERVICE MANUAL
(S/N 2001 AND ABOVE)

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3631 Perkins Avenue, Cleveland, Ohio 44114

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WARRANTY

CURRENT EQUIPMENT:

The Gould Recording Systems Division's products as shown in the Current Equipment Catalog are warranted for a period of one year from date of shipment to original purchaser. They are warranted to conform to the applicable published specifications in effect at the time of shipment, and to be free from any defects in material or manufacture when used with recommended Gould associated equipment and Gould chart paper. LIABILITY OF THE GOULD RECORDING SYSTEMS DIVISION UNDER SUCH WARRANTY IS LIMITED TO SERVICING OR REPLACING DEFECTIVE PARTS EXCEPT PENS, STYLI, FUSES AND BATTERIES AND DOES NOT INCLUDE CALIBRATION AND MINOR MAINTENANCE AS OUTLINED IN GOULD OPERATING MANUALS. (Exceptions: The thermal pen in the 110 Strip Chart Recorder is guaranteed for life. The magnetic head assemblies in the Tape Recorder are warranted for 1000 hours of use or (1) one year from date of first shipment whichever occurs first.) IN NO EVENT SHALL THE GOULD RECORDING SYSTEMS DIVISION BE LIABLE UNDER ANY CIRCUMSTANCES, FOR ANY LOSS OF PROFITS OR OTHER CONTINGENT, CONSEQUENTIAL OR SPECIAL DAMAGES. Units are to be returned transportation prepaid by the buyer. The Gould Recording Systems Division will have the right of final determination of the cause and existence of a defect under this warranty. This warranty shall not apply to any products which have been subjected to misuse, improper installation, repair, alteration, neglect, accident, inundation, fire or operation outside their published maximum ratings. THE FOREGOING WARRANTY IS EXCLUSIVE AND EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES WHETHER EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS AND OF ANY OTHER OBLIGATION AND SHALL CONSTITUTE THE SOLE REMEDY OF THE BUYER AND SOLE LIABILITY OF THE SELLER.

Gould offers an Extended Warranty Contract for all Recording Systems Division's products manufactured in the Cleveland Perkins' facility, along with calibration traceable to NBS. Please contact the Service Center listed below for details before your warranty expires.

REPLACEMENT PARTS: Same as above -- except ninety (90) days from date of shipment.

If a defect occurs:

1. Notify your nearest RSD Service Center (see below), giving full details of the difficulty, and include the model number, type number, and serial number. On receipt of this information, service data or shipping authorization and instructions will be forwarded to you.

2. On receipt of the shipping authorization, forward the instrument prepaid to location indicated on shipping authorization.

Compliance with the above procedure will assure the earliest repair and return of your equipment.

REFER TO REAR COVER FOR SERVICE CENTER LOCATIONS.

Gould instruments are individually tested and calibrated before shipment to assure dependability and verify their accuracy. To this procedure must be added an unseen ingredient of prime importance to you: The Gould concept of continuing service. Gould responsibility for each instrument sold covers far more than its delivery. Of equal concern is the equipment's suitability for its intended purpose, its correct installation, instruction of operating personnel -- plus future servicing and maintenance. The Gould Field Service Department offers customers any or all of these services:

Field Service

- o Installation
- o Field maintenance
- o NBS Certification

Training

- o Instruction of operators
- o On-site training seminars
- o Formal Training courses

Service Contracts

- o Fixed Fee
- o Time and Material
- o Extended Warranty

Our Seal of Pride Gould Inc., Recording Systems Division, and its predecessor organizations tracing back to Charles F. Brush, have been preeminent in instrumentation development since the 1920's. Among Gould's many achievements is a series of the world's best performing, most versatile, and reliable direct writing recording systems.

Today, Gould recorders and signal conditioners are the overwhelming choice for recording analog signals in the most critical industrial, scientific, and biophysical measurement applications. Whether recording the faintest life signals of a patient in a hospital operating room or the most critical variables in the lab or on the production line, you can depend on the accuracy, faithfulness, clarity, and permanence of the traces made by a Gould recorder.

Innovative design, coupled with highest quality, are hallmarks of all Gould products.

The Field Service Engineer Gould field service engineers provide on-the-spot assistance whenever and wherever it is required. While every field service engineer is the product of intensive and thorough factory training, you will find that his greatest strength evolves from field experience and his knowledge of your objectives. He is aware of your problems, is willing and able to assist you in their solution, and is backed by the nation's most experienced organization in recording instrumentation.

Our field service engineers and technicians are daily engaged in the installation, testing, maintenance, repair and inspection of Gould recording systems all over the country. They can provide you with any information about our instruments you may require; if not, they will find the answer to your problem.

Overhaul and Repair Because we service only our own products, our customers can feel confident of prompt, effective results when they turn to Gould Factory Service Centers.

The repair service these centers provide is of particular appeal to those companies that do not operate an instruments repair facility of their own. By designating the nearest Gould Service Center as its maintenance depot, a Gould-equipped company is assured the best chance for continuity of recording instrumentation.

Many companies with their own repair facilities find it more convenient and more truly economical to have their Gould equipment repaired by service contract with the closest Service Center. In addition to enjoying fast turn-around, these companies are spared the expense of carrying an inventory of recorder parts, accessories, and supplies.

Calibration and Certification A small, quiet room in the Standards and Calibration Section at the Gould plant in Cleveland contains precision reference standards just one step removed from the prime reference measurement standards of the United States – at the National Bureau of Standards in Washington. Included in this room which is temperature-controlled within one degree and has a constant relative humidity of 40%, are standards for voltage, frequency (derived from the atomic vibration of caesium), resistance, capacitance -- in fact all basic parameters of electrical measurement. The room is maintained under stabilized conditions 365 days a year.

The calibration practice of all Gould Service Centers is directly traceable to the National Bureau of Standards. We can supply complete calibration for any Gould equipment, and we can also certify to manufacturer's specifications followed by a letter of certification when required.

Training The Gould field service engineer will hold short training courses either on the job or at his facility. On-the-job training is usually a brief, informal session with the people who will actually be operating the Gould equipment.

Formal classroom training is more complete: detailed information, a thorough review of underlying theory, training devices, demonstration of problem solving and examination of students to determine their understanding and proficiency is accomplished at our Cleveland plant.

Contracts Customer companies requiring temporary or permanent service are afforded contract arrangements by which agreed-upon maintenance, repair, upgrading and calibration services are performed on a routine basis. Service contracts are now in effect with a number of customers, affording substantial savings in time and money.

Owing to the various requirements of each customer, we do not reproduce here a standard, boilerplate agreement -- which might contain too much or too little. Instead, we tailor each contract to a particular customer's needs. This practice has singlehandedly produced substantial savings in time and money for others; and it can do the same for you.

An extended warranty is available at the point of sale allowing a regulated budget for the first two years of ownership. You may take advantage of this warranty within the first year of ownership at a percentage of the current listed price.

SERVICE CENTERS

ATLANTA
RECORDING SYSTEMS DIVISION
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Suite D
Norcross, Georgia 30093
Phone (404) 441-5556

BOSTON
RECORDING SYSTEMS DIVISION
129 Middlesex Turnpike
Burlington, Massachusetts 01803
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Hayward, California 94545
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SECTION I

GENERAL INFORMATION

1.1 SCOPE OF MANUAL

This manual is provided for operators of Gould 2800S Direct Writing Recorders. The manual contains Recorder Description, Specifications, and a Supplies and Accessories list. In addition, this manual also contains detail service and repair information including Theory of Operation, Installation Procedures, Operator's instructions, Routine Maintenance, and Illustrated Parts Breakdown (IPB). Instructions for preamplifiers which may be used with these recorders are contained in their own applicable manuals.

WARNING: IN PATIENT CARE APPLICATION, ISOLATION TRANSFORMER [GOULD P/N 882895-3 (115V), -4 (230V) OR EQUAL] MUST BE CONNECTED BETWEEN POWER SOURCE AND RECORDER.

1.2 DESCRIPTION

The Gould 2800S Direct Writing Recorder (Figure 1-1) features a high performance stepper motor and microprocessor (digital) control along with optional chart edge thermal annotation of all pertinent real time test data. The recorder is self-contained in a 380mm mainframe chassis and can accommodate 8 isolated recording channels. The recorder may be housed in a portable case (Figure 1-1) or rack-mounted in a standard RETMA rack. (See Model Numbering Table for specific configuration.)

Incremental chart drive is a standard feature of the recorder. Its stepper motor and microprocessor (digital) control allows for quiet operation and chart speeds from 0.05mm/sec. to 200mm/sec. in 12 steps via front-panel pushbuttons or remote TTL inputs. The chart speed can also be varied continuously between steps with a front panel variable speed control or remote TTL pulse input.

Thermal Annotation option (Kit P/N 11-2123-51) records date, time, chart speed, test identification number and up to a 50 alphanumeric character user message. The on-board Real Time Clock setting can be changed as necessary or overridden by external IRIG-B time code feature (digital TTL, unmodulated). The RS232C interface allows information input through one of eight user-selectable 300 to 19,200 baud or manual rear panel hexadecimal thumbwheel switches. All information is retained in memory up to 72 hours during power off conditions by battery back-up. Waveform Recorder feature provides external trigger, memory and printout of Real Time to identify precise time triggered. Chart speed/date, time, and user message occur continuously with 10mm spacing between at all selectable fixed and variable speed settings.

NOTE: Thermal stripped Kromekote "TSK" paper must be used (P/N 11-2987-300) for thermal annotations.

The Gould 2800S Recorder employs a pressurized fluid writing system. The system uses fast drying ink which is applied to specially coated chart paper. The ink is contained in disposable plastic cartridges which can be replaced in minutes. Two standard event markers are provided and are located between channels 1 and 2, and 7 and 8.

1.3 MODEL NUMBERING SYSTEM

The model number of the 2800S Direct Writing Recorder designates the number of recording channels, type of mounting, preamp cage as required, and operating voltages. Table 1-1 on page 1.8 describes the various models. Appropriate outline dimensional drawings follow the model numbering table.

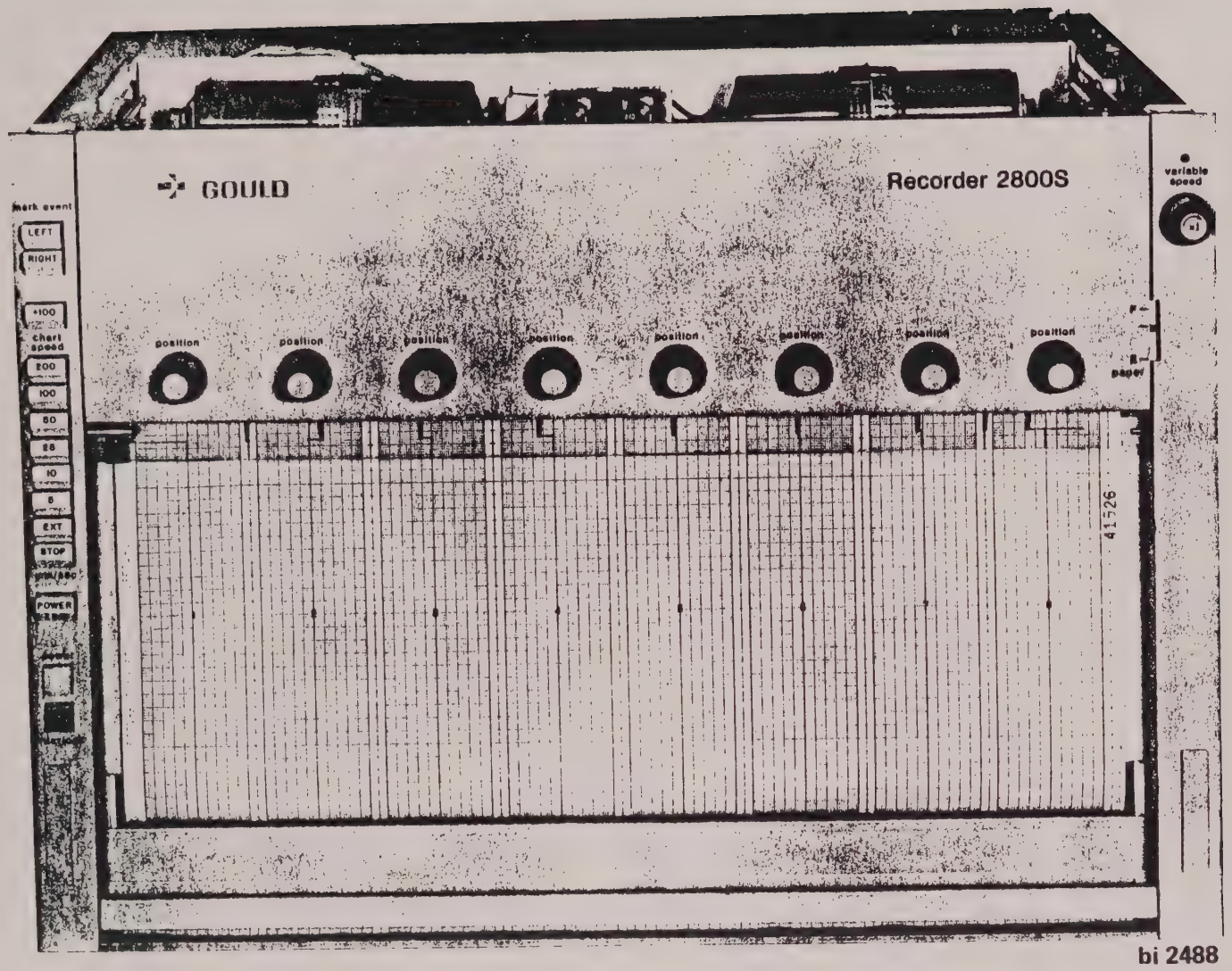


FIGURE 1-1 GOULD 2800S PORTABLE INK RECORDER

1.4 SPECIFICATIONS

1.4.1 General

Number of Analog Channels . . . . . Eight 40-mm (standard).

Number of Event Marker Channels . . . . . Two. Left and right margin.

Trace Presentation. . . . . .Rectilinear.

Trace Width. . . . . 0.01 nominal.

Marking Method . . . . . .Pressurized fluid (ink).

Marking Fluid Capacity. . . . . One-ounce replaceable, throw away cartridge.

Chart Speeds . . . . . .5, 10, 25, 50, 100 and 200 mm/sec. and divide-by-100. Selectable via front-panel pushbuttons or remotely via TTL or contact closure. Continuously variable via front-panel control or external pulse input.

Chart Speed Accuracy. . . . . ±0.25 @ 25° C ±10° C.

Chart Length. . . . . 275 ft. (94 mtrs) Kromekote. 400 ft (122 mtrs) reproducible.

Chart Width. . . . . 380mm (5.12 inches).

Divisions per Channel . . . . . 50 Divisions on 40mm channels.

Time Lines . . . . . One-mm by one-mm accentuated every 5mm and 100mm.

Chart Travel Direction. . . . . Top to bottom.

Paper Discharge. . . . . .Front.

Chart Wander . . . . . ±0.25mm.

Operating Temperature Range. . . . . 0° C to +50° C (+32° F to +122° F).

Storage Temperature Range . . . . . -40° C to +70° C (-40° F to +158° F).

Humidity. . . . . 95% @ 32° C (+90° F); Non-Condensing.

1.4.2 Electrical

Input Circuit. . . . . .Single-ended, floating (isolated from ground up to 500 VDC).

Input Impedance. . . . . .100 Kohm ±1% (recorder without preamps).

Input Signal. . . . . 5 volt span for 100 or 50mm channels.

Input Power . . . . . 100V, 115V, 200V and 230V ±10%, 50 to 400 Hz.

Power Consumption ..... (60W + 50W per channel).

Frequency Response .....100 div. @ 100 millimeter amplitude: dc to 30 Hz ±1 div.
50 div @ 50 millimeter amplitude: dc to 50 Hz ±1 div.
40 div @ 40 millimeter amplitude: dc to 55 Hz ±1 div.
10 div @ 10 millimeter amplitude: dc to 125 Hz ±1 div., down less than 3 dB @ 140 Hz.

Rise Time (10% to 90% full scale with less than 1% overshoot) .....At 100mm amplitude: less than 8 msec.
At 50mm amplitude: less than 5 msec.
At 40mm amplitude: less than 4 msec.

Noise ..... 0.1mm peak-to-peak, R = 1 Kohm.

Non-Linearity ..... ±0.35% of full scale.

Pen Position Control ..... 270° rotation single turn potentiometer, one per channel.

Maximum Allowable Signal Input Voltage to Avoid Damage ..... ±50 Vdc or peak AC (recorder without preamplifiers).

Maximum Safe Common Mode Voltage ..... 500 Vdc or peak AC.

Common Mode Rejection Ratio .....60 dB @ 60 Hz (R = 1 Kohm, recorder w/o preamps).
80 dB @ dc (r = 1 Kohm, recorder w/o preamps).

Signal Limiters ..... Built-in adjustable and mechanical. (Limiters prevent pen damage from off-scale overloads).

Zero-Line Instability (Drift) ..... ±0.1% of full scale for 24 hours.
±0.025% of full scale per °C.
±0.1% of full scale for ±10% line voltage change.

Gain Instability ..... ±0.1% of reading for 24 hours.
±0.05% of reading per °C.
±0.5% of reading for ±10% line voltage change.

Remote Control Operation .....All speeds selectable thru rear panel connector J-102 and are TTL compatible.

Internal Timer (Standard on all recorders) .....Produces 40ms duration pulses at internally programmable repetition rates of: 0.1, 1, 10 and 100 sec. and 0.01, 0.1, 1 and 10 minutes.

External Pulse Speed Control .....Chart speed is continuously variable via TTL pulse train. Frequencies of 0 to 20 KHz corresponds to chart speeds of 0 to 250mm/sec in a linear relationship.

External Pulse Input ..... 3 TTL Loads, minimum 10 μsec. Negative pulse width, 0-20 KHz. Stepping occurs on negative transition 79.8 pulses/mm.

Variable Speed Control ..... Continuously variable over a range of 2.5:1 down to next lower speed.

1.4.3 Thermal Annotation Kit (11-2123-51) Specifications

Character Format ..... 5 x 7 dot matrix; 0.112 inch high; 10 characters per inch.

Character Set ..... ASCII upper case Hex 20-5F.

Maximum Chart Speed for Annotation ..... 200 mm/s.

Annotation Location ..... Left margin of chart.

Head Placement ..... Approximately channel time line.

Character Orientation ..... Horizontal, left to right, when viewed with right hand chart margin at bottom.

Resolution of Displayed Time ..... Nearest one second.

Speed Annotation Accuracy ..... In detent calibrate position, the exact speed selected will be printed. In uncalibrated variable speed mode, inaccuracy is less than 5%.

Operating Temperature ..... 0° C to +50° C, external to enclosure.

Storage Temperature ..... -40° C to +70° C.

User Inputs ..... Serial via RS232C, or parallel via Hex switches.

Battery Backup ..... Up to 72 hours without power.

Baud Rates ..... 300, 600, 1200, 2400, 9600, 14400 and 19200, internally selectable by DIP switches.

Printing Update ..... Continuous with approximately 10mm spacing between messages. Speed change will immediately result in reset.

Timing Mark ..... Printed before the time to indicate exact point corresponding to printed time.

1.4.4 Physical

Principle Dimensions ..... Refer to outline dimensional drawings following model numbering table.

Weight ..... 77.5 lb (34.9 Kg) Portable Case 12.5 lb (5.6 Kg) Portable case w/preamp cage 4.0 lb (1.8 Kg). Preamps 3.5 lb (1.6 Kg) each average.

Finish ..... Light and Dark Parchment.

1.5 SUPPLIES AND ACCESSORIES

1.5.1 Supplies

Chart Paper (All Models)

High Contrast, Kromekote (275 feet) 1mm time line

Eight 40mm channels (not perforated) 11-2983-31
Eight 40mm channels (semi-perforated with optical sensing marks and page numbers) 11-2983-301
Eight 40mm channels reproducible 11-2983-41
Eight 40mm channels thermal annotation paper for pressure ink recorder 11-2987-300

Analog Pen

(includes ink tube, lapping paper, and pen pressure adjustment wrench) 11-2823-35

Event Marker Pen 11-2873-20

Ink Tube (Event Marker Pen) 667447-1

Ink Cartridge (1 oz. Blue Ink) 11-2730-01

Gram Gage 240601-910

Plug, Signal Input, P-201 (shipped loose with recorder) 114816-15

Plug, Monitor, P-202 (shipped loose with recorder) 289046

Connector, P-102 (shipped loose with recorder) 245537

1.5.2 Accessories

Starter Kits

Starter kits include 12 rolls of high contrast chart paper, gram gage, one analog pen, lapping paper and pen pressure adjustment wrench. Below are starter kit model numbers.

Eight 40mm channels (non-perforated) 11-6250-32
Eight 40mm (semi-perforated) 11-6250-36
Eight 40mm (semi-perforated) 11-6250-45

Blank Amplifier Module 13-4615-09

Blank Amplifier Panel 887005

Fuse Kits

115V, 50-400 Hz. 694921-00
100V, 50-400 Hz. 694921-01
230V, 50-400 Hz. 694921-06
200V, 50-400 Hz. 694921-07

Drive Amplifier Extender Card 887526

Pen Pressure Adjustment Wrench 1-120922-18

Band, Penmotor 684999

Ink Tube Replacement Tool 267528

Rack Mounting Kits (for conversion of portable units)

2800S Recorder with Preamp Cage 11-1202-14
2800S Recorder without Preamp Cage 11-1202-15

Mobile Carts 11-6405-02

Chart Take-up 11-6402-12

Interchannel Event Marker (includes pen when ordered with recorder) 11-2123-37

Thermal Annotation Kit 11-2123-51

500 Watt Portable Isolation Transformer (for patient care applications) 882895-3 (115VAC)
882895-4 (230VAC)

TABLE 1-1 2800S SERIES MODEL NUMBERING SYSTEM

2107-XXXX-XX

Operating Voltages

00	115V ±10%, 60 Hz, divide by 100 chart speeds
04	115V ±10%, 400 Hz, divide by 100 chart speeds
05	115V ±10%, 50 Hz, divide by 100 chart speeds
06	230V ±10%, 50 Hz, divide by 100 chart speeds
10	115V ±10%, 60 Hz, divide by 60 chart speeds
14	115V ±10%, 400 Hz, divide by 60 chart speeds
15	115V ±10%, 50 Hz, divide by 60 chart speeds
16	230V ±10%, 50 Hz, divide by 60 chart speeds

Type of Mounting and Preamplifier Cage and Frame Configuration

00	Portable case for recorder only
08	Portable case and eight preamp cage
10	Rack mounting kit and shipping frame for recorder only
18	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps and shipping frame
20	Rack mounting kit and vertical cabinet for recorder only
28	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps and vertical cabinet
30	Rack mounting kit, shipping frame, and ac power kit for recorder only
38	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, shipping frame and ac power kit
40	Rack mounting kit, vertical cabinet and ac power kit for recorder only
48	Rack mounting kit, 8 channel preamp frame for 4600 Series preamp, vertical cabinet and ac power kit
50	Rack mounting kit, shipping frame and 30 microampere isolated power kit for recorder only
58	Rack mounting kit, 8 channel preamp frame for 4600 Series preamp, shipping frame and 30 microampere isolated power kit
60	Rack mounting kit, vertical cabinet and 30 microampere isolated power kit for recorder only
68	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps, vertical cabinet and 30 microampere isolated power kit
70	Rack mounting kit, recorder only
78	Rack mounting kit, 8 channel preamp frame for 4600 Series preamps

Number of Channels

88	Eight 40mm channels, chassis assembly, drive amplifiers and timer

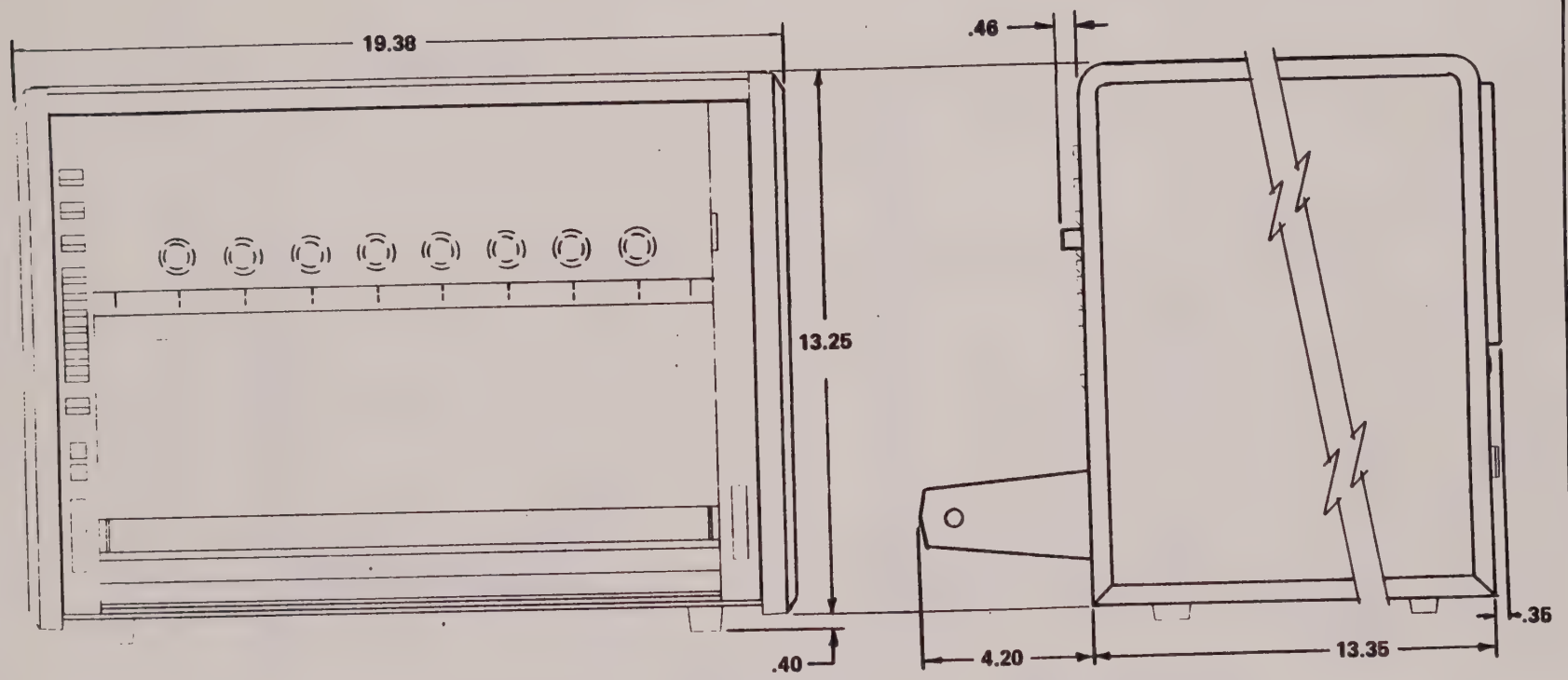


FIGURE 1-2 OUTLINE DIMENSIONS - 2800S RECORDER

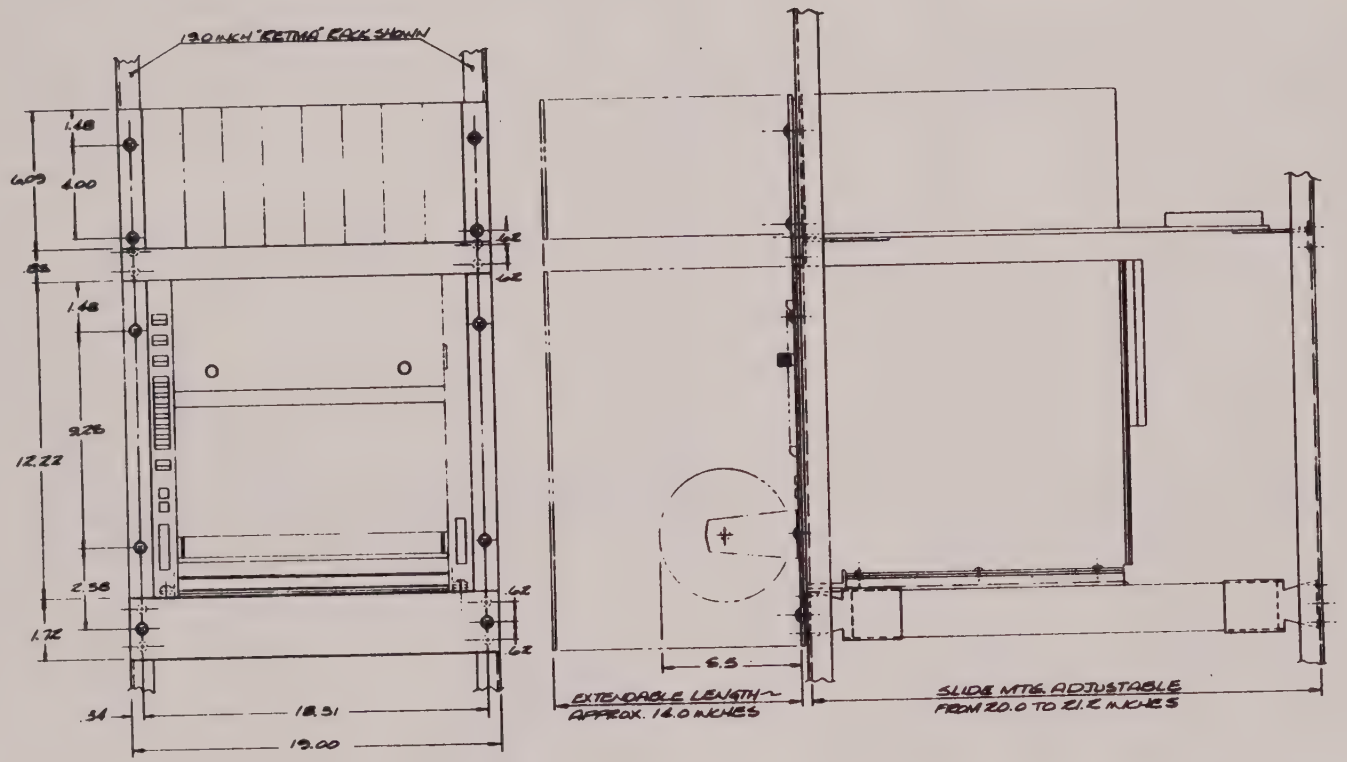


FIGURE 1-3 OUTLINE DIMENSIONS - 2800S RACK MOUNT RECORDER

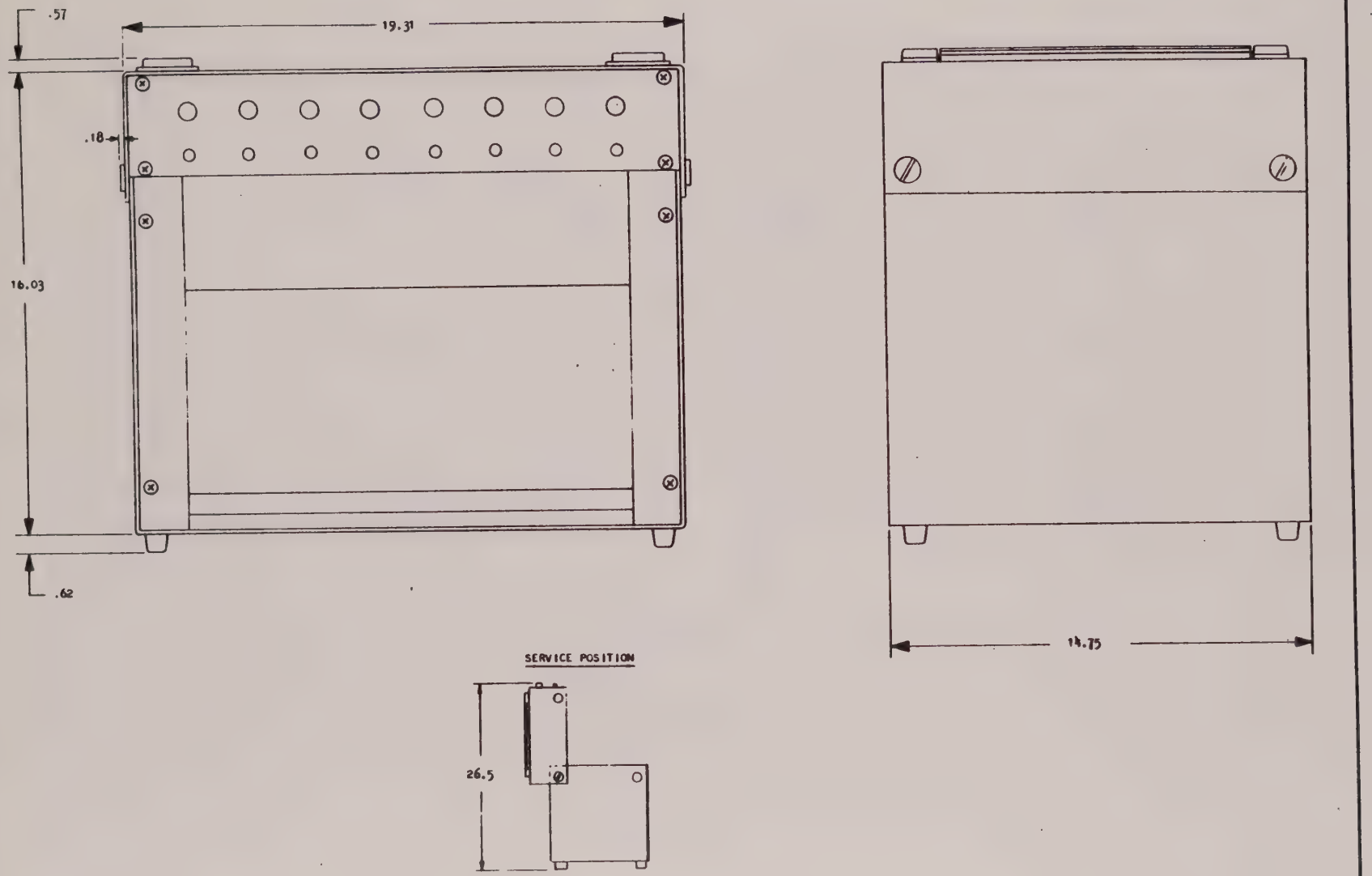


FIGURE 1-4 OUTLINE DIMENSIONS - 2800S RECORDER w/50mV PREAMP PANEL

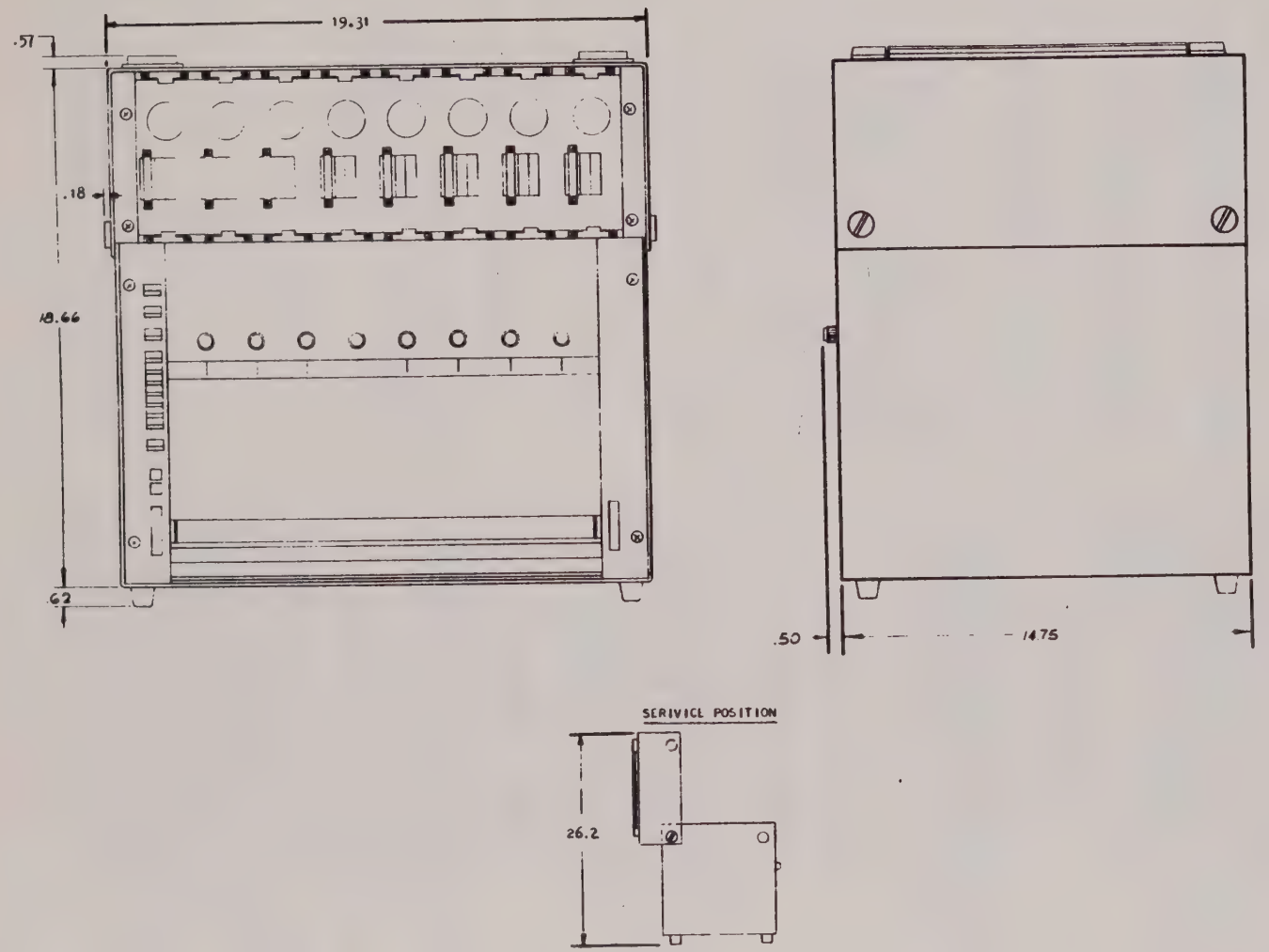


FIGURE 1-5 OUTLINE DIMENSIONS - 2800S RECORDER w/TOP MOUNTED PREAMP CAGE

SECTION II

INSTALLATION

2.1 GENERAL

This section contains information necessary to put the recorder into service, including installation of optional equipment.

2.2 SERVICE UPON RECEIPT

CAUTION: POWER MUST BE OFF DURING THE FOLLOWING SEQUENCE.

Before making signal connections and applying power to the recorder, the following service must be performed:

1. Remove sheet of chart paper from under pens and load roll of chart paper as described in Section V.
2. Slide all manual ink valves with tubing attached to ON position. (Follow direction of arrows on manifold bar.) Valves are located on top of recorder. Remove the recorder top front cover to gain access to valves. Slide cover forward and lift out. (If recorder is rack mounted, slide recorder out of rack.)
3. Ink cartridge and ink solenoid valve are turned on prior to shipment from factory.

NOTE: Ink cartridge should be near full.

4. Place cover back in position (or slide recorder back into rack and secure).

2.3 LINE VOLTAGE REQUIREMENTS

The last digit of the model number designates line voltage. Frequency range for all models is 50-400 Hz. Listed below is last digit of model number and required line voltage.

DIGIT	LINE VOLTAGE
0	115 Vac
1	100 Vac
6	230 Vac
7	200 Vac

CAUTION: MAKE SURE A.C. JUMPER BOARD IS IN CORRECT POSITION (PARA. 2.9).

2.4 ANALOG SIGNAL CONNECTIONS

2.4.1 Without Preamplifiers

On recorders not supplied with preamplifiers, signal input connections are made directly to pen drive amplifiers. Two phone jacks are provided on each drive amplifier. They are located on the rear of the recorder (Figure 2-1). Use shielded cable (Belden 8422 or equal) with mating phone plugs provided. Tips are high; rings are low; barrels are common.

2.4.2 With Preamplifiers

On recorders supplied with preamplifiers, signal input connections are made via a connector located in the preamplifier cage. Refer to applicable preamplifier manual for their signal input connections.

2.5 EVENT MARKER INPUTS

2.5.1 Standard Event Markers

Left and right markers are standard. Actuation is made by momentary switches on front panel or externally via the terminal strip located on recorder rear panel. External actuation may be made by contact closure or TTL signal input. Refer to Figure 2-2 for connections.

2.5.2 Optional Event Marker

Interchannel optional event marker is actuated by a contact closure via the rear panel terminal strip. Refer to Figure 2-2 for connections.

2.6 REMOTE CHART DRIVE (Stop/Start)

For remote chart drive operation, remove jumper between terminals 3 and 4 on rear panel terminal strip. Front Panel speeds are disabled during remote operation. A contact closure across these pins will "remote enable" chart drive motor. Refer to Figure 2-2. Chart SPEED must be pre-selected. Remote Start/Stop operation, as well as speed control, can also be operated via J-102 covered in para. 3.7.

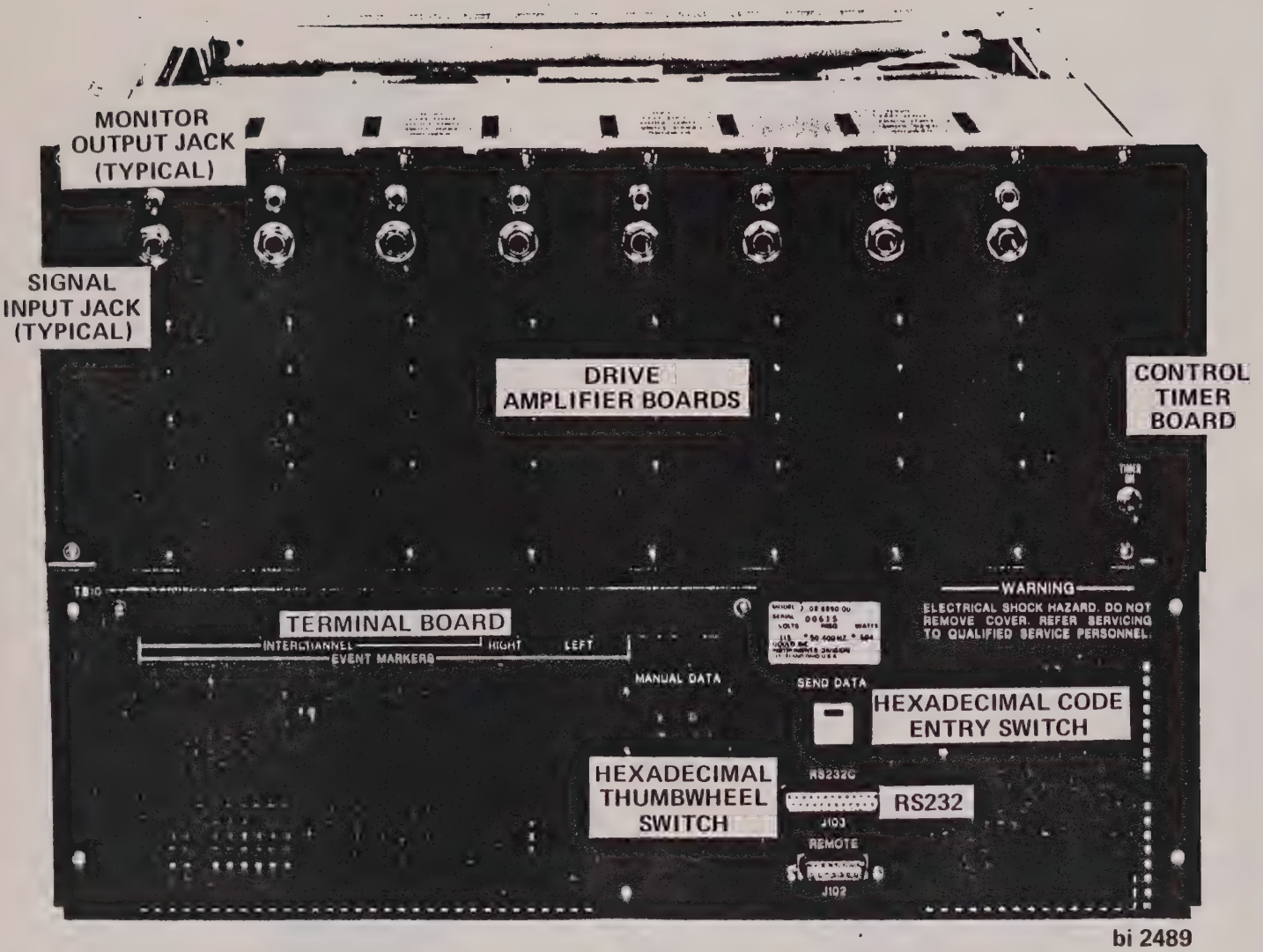


FIGURE 2-1 SIGNAL INPUT CONNECTIONS

2.7 CHART TAKE-UP INSTALLATION

Refer to Figure 2-3, and install the optional chart take-up as follows:

1. Disconnect recorder from power source.
2. Remove case from recorder as described in para. 5.3.6 (or slide recorder about 6 inches out of rack). (Refer to Figure 2-5).
3. Remove plastic caps covering slots in front panel.
4. Position chart take-up on front panel with drive belt on left side. Secure with screws and lockwashers.
5. Slide pulley onto drive roll shaft, and secure with cotter pin.
6. Position drive belt over pulley.
7. Reinstall case.

2.8 RACK MOUNTING KITS

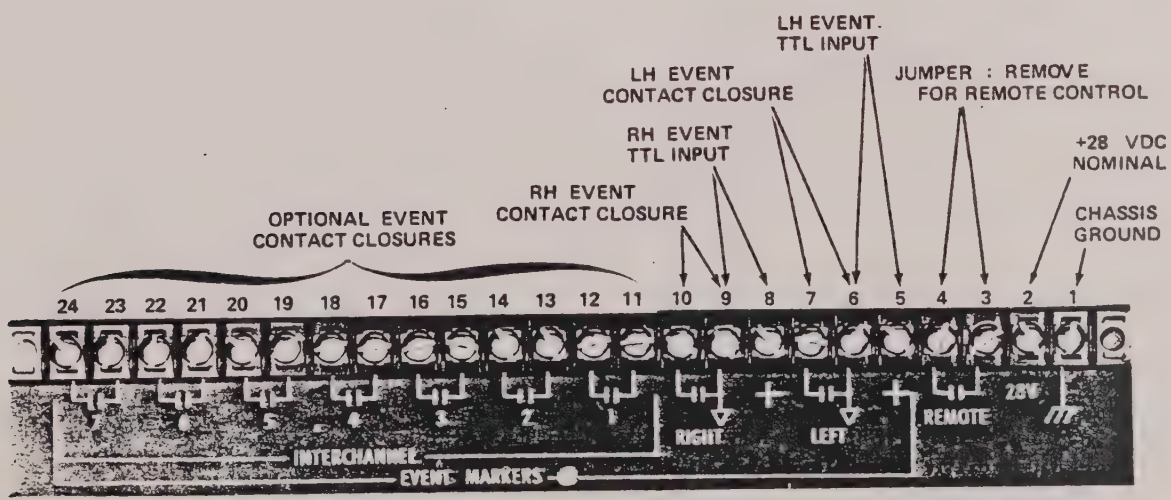
Rack mounting kit for recorder without preamps is Model 11-1202-14; for recorder with preamp cage use model 11-1202-15. Installation instructions are included with each kit.

2.9 A.C. JUMPER BOARD

WARNING: REMOVE POWER SOURCE.

If it becomes desirable to operate the recorder at some voltage other than the specified one, the A.C. Jumper Board (Figure 2-4) must be repositioned, and the fuses replaced.

The A.C. Jumper Board is located behind the writing table. To gain access to the board, open the table and remove the chart paper roll (para. 5.2.1). The board will immediately become visible when looking into the recorder. The voltage the unit is set to operate at appears on the left side of the board.


LH EVENT. TTL INPUT
LH EVENT CONTACT CLOSURE
JUMPER : REMOVE FOR REMOTE CONTROL
RH EVENT TTL INPUT
+28 VDC NOMINAL
RH EVENT CONTACT CLOSURE
OPTIONAL EVENT CONTACT CLOSURES
CHASSIS GROUND
24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
RIGHT
LEFT
REMOTE
28V
INTERCHANNEL
EVENT MARKERS

NOTE: "L" SHAPED SHIELD, STANDARD, (not shown) PROTECTS TERMINAL BOARD.

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FIGURE 2-2 REAR PANEL TERMINAL CONNECTIONS

The procedure that follows describes repositioning the A.C. Jumper Board.

1. Carefully place screwdriver blade between "EAR" of board and "CONNECTOR" and pry board upward from connector, first from one "EAR", then the other (See Figure 2-4).
2. Remove board from recorder once loosened. Select desired voltage, reading voltage number on left side of board (facing reader).
3. Place board back into connector making sure it is seated correctly.
4. Install appropriate fuses on Control Timer board (see Figure 2-1). Refer to Tables 4-1 and 6-1 for options.
5. Replace chart paper roll and close writing table. Refer to Section III, Operation, before attempting to operate recorder.

2.10 THERMAL ANNOTATION OPTION

Refer to Section III Operation if option 11-2123-51 is included, further installation is not required.

Installation instructions are not included for retrofitting units originally ordered without Thermal Annotation. Contact an authorized Gould Service Center to add this option. Installation by other than qualified Gould Service Engineers may void warranty.

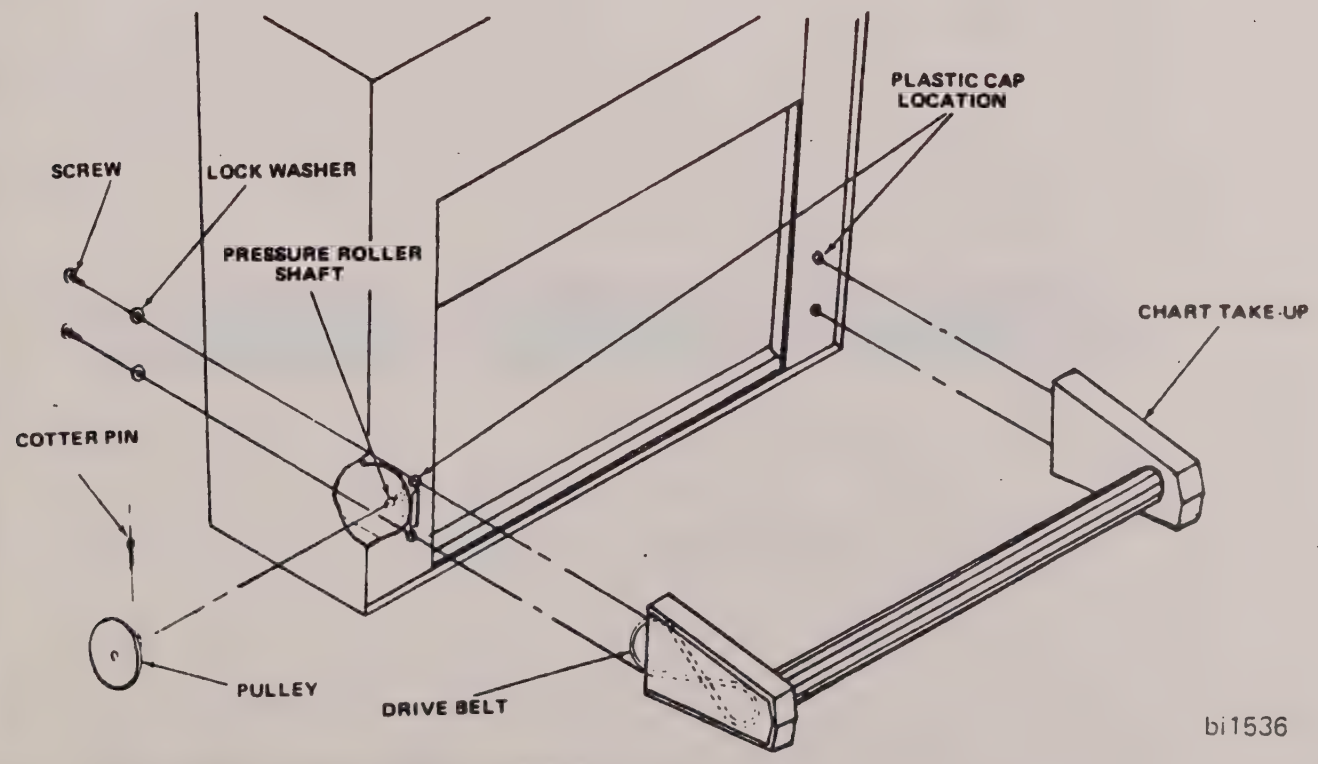


FIGURE 2-3 CHART TAKE-UP INSTALLATION

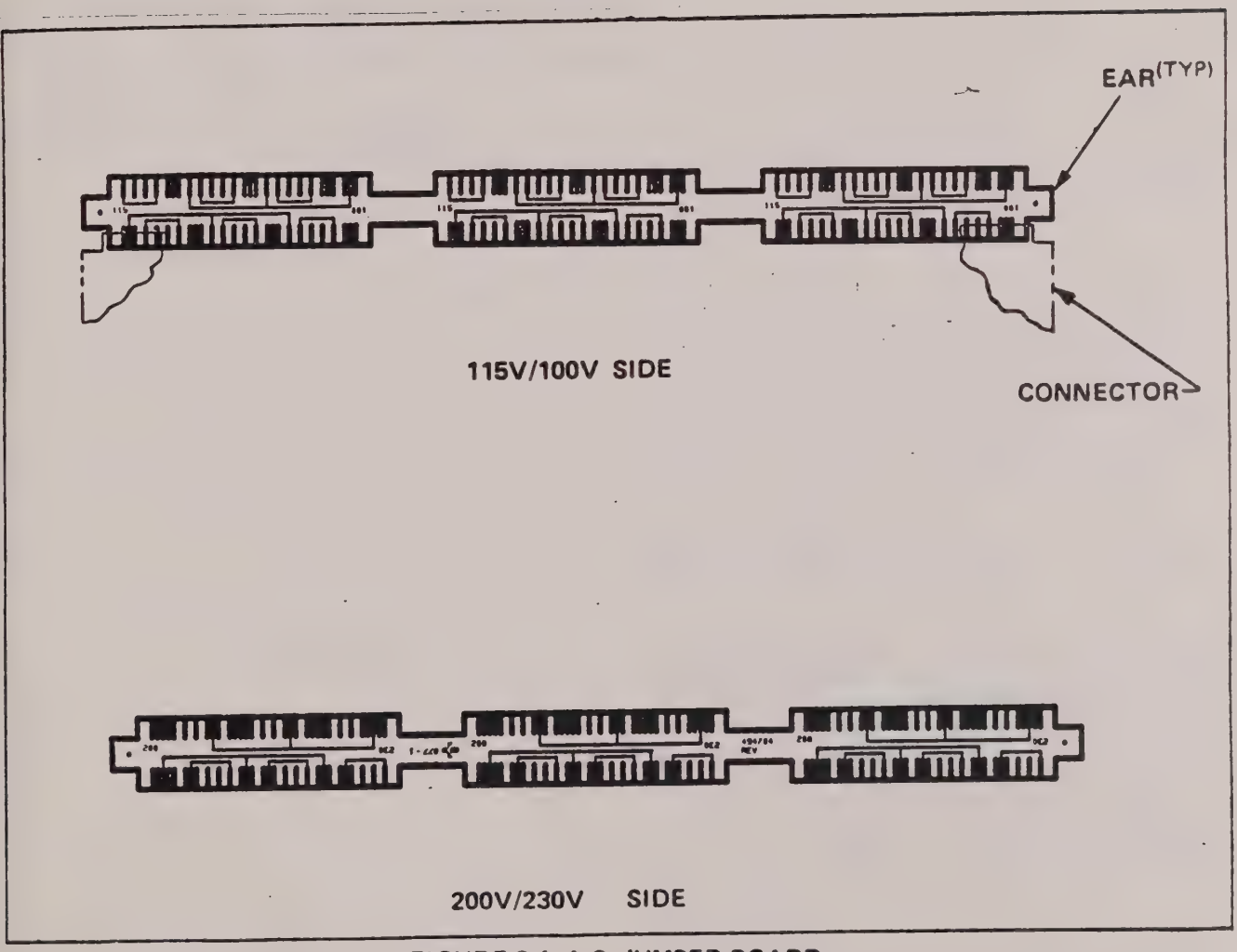


FIGURE 2-4 A.C. JUMPER BOARD

SECTION III

OPERATION

3.1 GENERAL

This section provides complete instructions for operation of the recorder. Functional descriptions of the controls and indicators are provided. If the recorder is equipped with preamplifiers, refer to their applicable instruction manuals for operating instructions.

CAUTION: NEVER APPLY POWER TO RECORDER WITH POWER BUTTON IN "ON" POSITION.

3.2 FRONT PANEL CONTROLS & INDICATORS

Figure 3-1 illustrates the front panel controls and indicators. The list that follows corresponds to the items called out on Figure 3-1.

ITEM	CONTROL	DESCRIPTION
1	POWER SWITCH/ POWER LAMP	Controls AC to recorder. Depress to turn recorder ON or OFF. POWER lamp is lighted when recorder is ON.
2	CHART SPEED SELECTION	Permits selection of six calibrated chart speeds of 5, 10, 25, 50, 100 and 200 mm/second and STOP. When in STOP position chart drive is off, and pens will not respond to input signals. Depressing any chart speed button will activate the chart drive at the selected speed. Chart speeds may be changed while chart drive is running. However, during remote** operation all front panel controls are disabled except for power On/Off pushbutton.
3	DIVIDE BY SWITCH	When depressed chart speed will be divided by 60, 100 or 1000 depending upon internal processor board DIP switch ÷ speed selection.
4	*VARIABLE SPEED CONTROL	Single turn potentiometer with 270° rotation. Provides continuously variable speeds between calibrated selected chart speed, and overlapping next lower calibrated speed. When control is at full CW (calibrated detent) position (x1), chart speed matches selected speed. As control is rotated CCW chart speed is reduced. When rotated full CCW uncalibrated speed is reduced 2.5 times and will be slower than next lower calibrated speed. If optional Annotation is activated, exact uncalibrated speed can be Annotation with less than 5% inaccuracy.
5	MARK EVENT	Two momentary switches permit manual marking of an event. When left MARK EVENT button is depressed the left event marker pen will deflect to the left. **NOTE: The EVENT MARKER pens will remain deflected until the MARK EVENT button is released. Event Marker will override timer event marker.**

ITEM	CONTROL	DESCRIPTION
6	*PEN POSITION POTS	Permits pen positioning anywhere within the channel.
7	PULL BAR	Pull to gain access to chart paper supply roll.
8	INTERLOCK INDICATOR	Lamp lights when writing table is not completely closed or paper supply is exhausted.
9	PAPER SUPPLY INDICATOR	Gauge to indicate quantity of chart paper remaining.
10	EXTERNAL CONTROL	When depressed, the recorder speed will be determined by an externally supplied pulse train, provided the system is in local** (or no connection is made to J-102 pin 6). This control is disabled in remote**. (External pulses may still be used in remote**, as explained in paragraph 3.8).
11	PREAMPLIFIERS	Refer to applicable preamplifier manuals for operating instructions.
12	THERMAL ANNOTATION HEAD (Option)	When activated will ANNOTATE on left edge of paper all or selected parts of the following message in the order listed. 1. Time 2. Date 3. Chart Speed 4. User Message 5. Test Number

*VARIABLE SPEED CONTROL and PEN POSITION pots contain locking knobs.

**Either "local" or "remote" is selected by the switch labeled "local-remote" in the remote speed control box shown schematically in Figure 3-4. "Local" means control by the recorder front panel controls. "Remote" means external control via J-102 and a circuit such as the Figure 3-5 box. See paragraph 3.8 for remote operation.

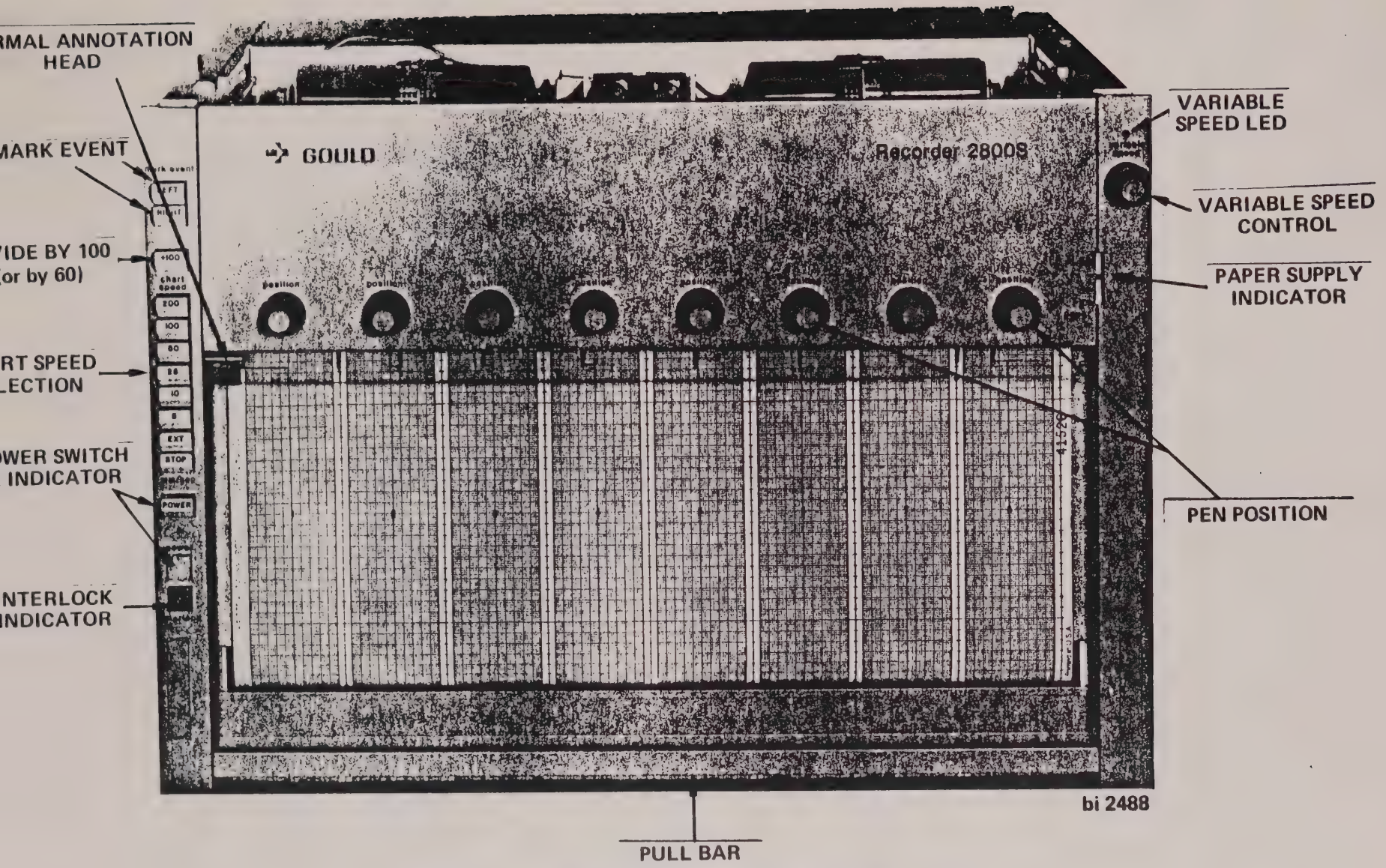


FIGURE 3-1 FRONT PANEL CONTROLS AND INDICATORS

3.3 REAR PANEL

Figure 3-2 illustrates the recorder rear panel. The list that follows corresponds to the items called out on Figure 3-2.

ITEM	CONTROL	DESCRIPTION
1	PREAMP CAGE	Houses preamplifiers if part of the recorder system.
2	SIGNAL OUTPUT	Jacks for signal input direct to drive amplifiers. (Overrides preamplifiers).
3	TERMINAL STRIP (TB-101)	Refer to paragraph 2.5 for description.
4	TIMER	ON/OFF toggle switch for timed left hand event marker activation. See Section 3.5.
5	MONITOR JACK	Monitors output of preamplifier (regardless of chart display). For use on Scope, Meter, Output panel, etc.
6	REMOTE CONTROL CONNECTOR (J-102)	Allows recorder to be operated from remote location. Proper input must be made to J-102 as explained in Section 3.8. IRIG-B (Thermal Annotation option) input, also available on this connector, allows time information from an external source, replacing the on-board real time clock. Information is pulse width coded and may be used as DC level shift coded (unmodulated digital TTL), BCD or binary format.
7	POWER INPUT CONNECTOR (J-101)	Connector accepts external power, i.e., 115/230V, 50-400 Hz.
8	RS232C CONNECTOR (J-103) (Option)	Serial User Input of various thermal annotation control and ASCII characters. The 300, 600, 1200, 2400, 9600, 14400, and 19200 BAUD are selectable by DIP switch on Processor Board. (Refer to Table 3-6 for pin-outs).
9	MANUAL DATA	Hex switches to enter two hexadecimal numbers for various thermal annotation control and ASCII characters, providing the user manual means of input instead of via RS232C.
10	SEND DATA	Pushbutton used to send hex switch information to microcomputer with error light to indicate necessary reset.

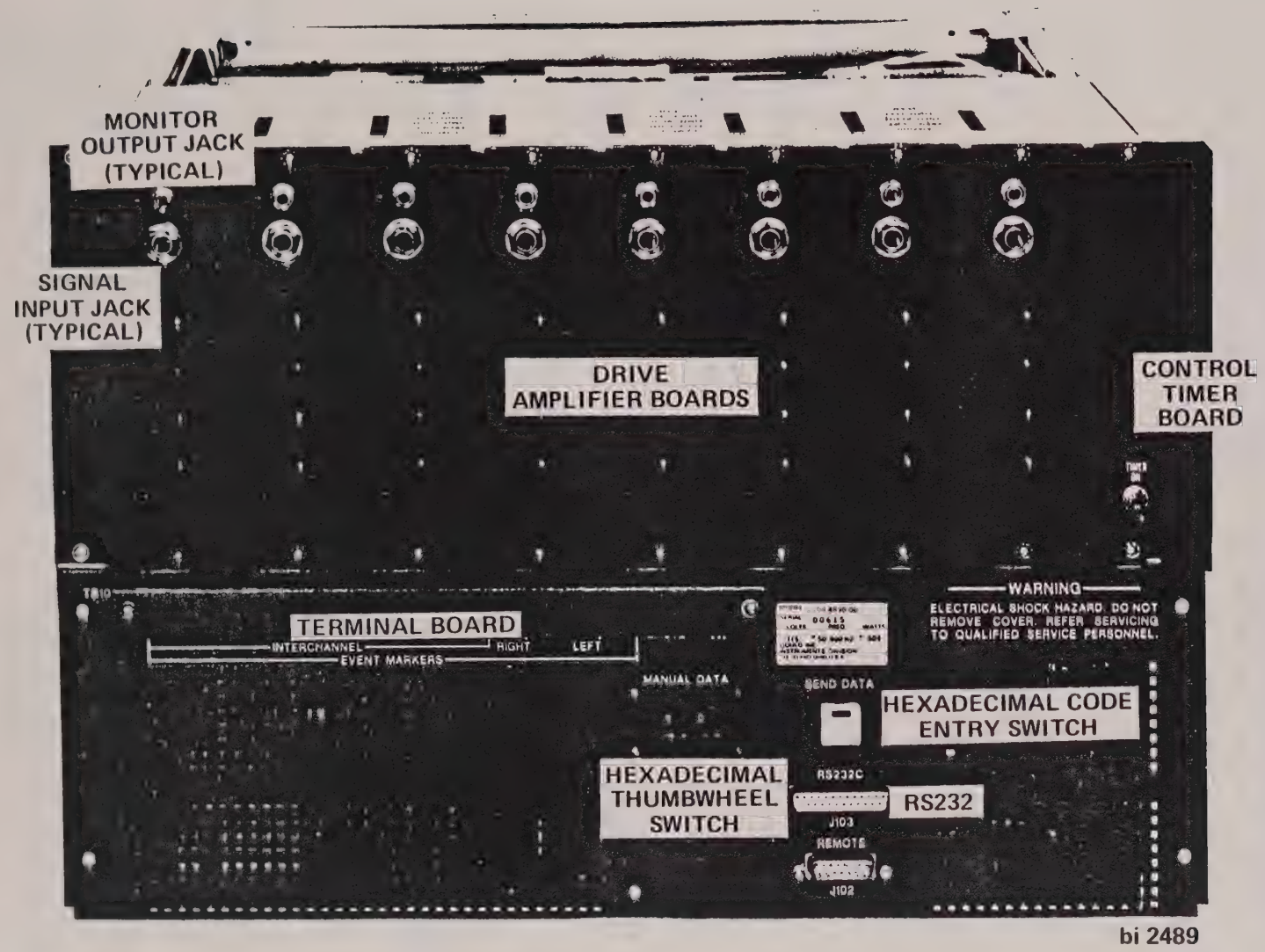


FIGURE 3-2 REAR PANEL

3.4 INTERNAL CONTROL DIP SWITCH

Figure 3-3 illustrates DIP switch located internally on the Processor Board. Switches 2 and 3 program front panel speed selection switch for either divide by 100, 60 or 1000. Switches 4, 5 and 6 select RS232 Baud for optional thermal annotation kit.

3.5 TIMER SETTING

The timer actuates left event markers at a programmed repetition rate. Selection of repetition rates is made via switch S-702 on the Control Board.

Set rate as follows:

NOTE: If the customer wishes the right event marker timer to be actuated, see paragraph 3.6.

1. Turn recorder power OFF.
2. Loosen the two screws which secure Control/ Timer board and pull board out of recorder. (See Figure 3-2).
3. Set switch positions for desired repetition rate per Table 3-1.
4. Replace control timer board and secure with screws.
5. Turn recorder power ON.
6. Turn TIMER switch ON. Timer ready for operation.

TABLE 3-1 SWITCH SETTINGS VS. TIMER REPETITION RATE

REPETITION RATE	SETTINGS	
	SW ON	SW OFF
0.1 SECOND	1, 3	2, 4, 5, 6, 7, 8
1.0 SECOND	1, 4	2, 3, 5, 6, 7, 8
10.0 SECONDS	1, 5	2, 3, 4, 6, 7, 8
100.0 SECONDS	1, 6	2, 3, 4, 5, 7, 8
0.1 MINUTE	2, 3	1, 4, 5, 6, 7, 8
0.10 MINUTE	2, 4	1, 3, 5, 6, 7, 8
1.00 MINUTE	2, 5	1, 3, 4, 6, 7, 8
10.00 MINUTES	2, 6	1, 3, 4, 5, 7, 8

3.6 RIGHT EVENT TIMER ACTUATION

By the removal of one resistor and the addition of another on the Control/Timer Board, the timer will actuate the right hand event marker.

Procedure for right event timing marks are as follows:

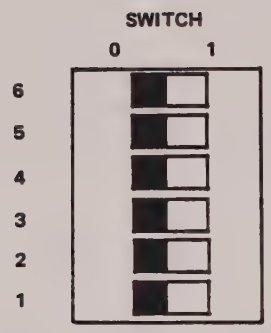
1. Turn recorder power OFF and disconnect AC power.
2. Remove the two screws which secure Control/ Timer board and pull board out of recorder.
3. Locate resistor R708 on the Control/Timer Board and remove it (see Figure 6-8).
4. Add resistor R709 to Control/Timer Board, 3.3 Kohm ±5% 1/4 watt carbon resistor part number 5-241111-332.
5. Replace Control/Timer Board and secure with screws.
6. Turn recorder power on.
7. Turn TIMER switch on. Right hand event marker should be responding to programmed repetition rate.

3.7 SET-UP AND OPERATION

Prepare recorder for operation as follows:

CAUTION: MAKE SURE ALL PROCEDURES DESCRIBED IN SECTION II, INSTALLATION HAVE BEEN PERFORMED.

1. Connect power source to recorder via power cable.
2. Check chart paper supply level. Make sure an adequate supply is present for length of time recorder is to be operated and that paper is properly threaded.
3. Check that chart STOP pushbutton is depressed (in).
4. Depress POWER pushbutton. POWER lamp will illuminate.



ALL SWITCHES SHOWN IN 0 POSITION

BAUD RATE SELECT

Switch 6 5 4	Frequency (Hz)	Baud Rate
0 0 0	2,400	300
0 0 1	4,800	600
0 1 0	9,600	1,200
0 1 1	19,200	2,400
1 0 0	76,800	9,600
1 0 1	115,200	14,400
1 1 0	153,600	19,200

DIVIDE-BY SELECT

Switch 3 2	Divisor
0 0	/100
0 1	/60
1 0	/1000

FIGURE 3-3 INTERNAL CONTROL DIP SWITCH

5. Set variable speed control full clockwise to detent.

6. Depress 5 mm/sec calibrated chart speed pushbutton (÷ 100 pushbutton should be out). Allow chart to travel about one foot. Press STOP button. Vertical traces from analog pen(s) down the center of the chart and vertical traces with timed marker (per paragraph 3.4) from the event marker pens on the chart edges will appear.

7. Depress 5 mm/sec chart speed pushbutton. Rotate pen position control(s) allowing analog pen travel to show full scale deflection within chart limits. Center pen(s) on chart with pen position control(s). Press STOP button.

8. Apply input signal(s) to recorder.

9. Depress calibrated chart speed pushbutton to that chart speed which best displays signal. Speed may be fractionally reduced as low as next slower calibrated speed by rotating variable speed control counterclockwise. Lock control in place when desired speed is attained.

10. When recorded data is completed, remove input signal(s), depress STOP button, and rotate variable speed control full clockwise unless setting is desired for recording future data.

11. Remove power by releasing POWER pushbutton.

3.8 REMOTE CONTROL OPERATION

The recorder may be operated remotely thru remote control connector J-102 located on the rear panel of the recorder. To attain this, mating connector P-102 (shipped loose with recorder) must be wired and closures provided per Tables 3-4 and 3-5. Figure 3-5 shows a suggested circuit for a remote control box (this box is not supplied by Gould as standard equipment with the recorder). Page 1 of Schematic Diagram 294232 located at the rear of this manual may be used as an aid. Signals S1 thru S4, STOP, ENABLE and x100 are pulled to a logic 1 internally. The stop signal pin number 1 of J-102 will override front panel speed selection if connected to a logic 0.

Also, refer to note **. When in remote**, chart speed is determined by signals S1-S4 per Table 3-5. As the table shows, these signals can also select speed control by an external pulse train by setting S2 to 1 (open) with S3 & S4 to 0 (closed). S1 doesn't matter for external pulse in.

Another feature in J-102 is a pulse output (pin 7), which can be used to synchronize the speed of other recorders (via their "EXT IN") to the speed of the main recorder. See Figure 3-4.

3.9 THERMAL ANNOTATION OPTION (11-2123-51)

Operation is standard for both recorders that originally have Annotation or converted later with a kit (11-2123-51). Control and data can be entered by either:

1. MANUAL DATA and SEND DATA switches.
2. RS232C (J-103) connector.

If recorder is not printing, make sure annotation is enabled by entering (EA) from RS232C or Hexadecimal 90 on MANUAL DATA switch and then push SEND DATA. Check to see if any of the information is enabled, and if not, enable desired information by entering correct character from Table 3-2 CONTROL CHARACTER MNEMONICS.

3.9.1 Hex Manual Data Information Input

1. Whenever a "00" is entered by the pushbutton or the external trigger (pin 13 of the remote connector), the time the event occurred will be stored in memory and printed on the next annotation cycle. An asterisk, instead of the usual arrow will indicate the real time the event occurred, then followed by an arrow with real time followed by date, speed and user message (providing they are enabled).

2. User message (numbers and letters) must be input in ASCII Code via Hex switches (see Table 3-3), one character at a time followed by pushing the SEND DATA button. If character is not a legal character, error light will come on until a legal character is entered. Error light will also come on if the message buffer is full. Entry of user message is terminated by a carriage return (0D) command, or by a chart speed change or RS232 input. Character entry mistakes can be erased by entering a RUBOUT character (7F) after the mistake is made.

3. User will be notified of any command or data

input error by the error light on the push-button. It will be cleared by entering either proper data or a legal command.

4. To set and enable test number printing, a number must follow command input, even if only 00. Test numbers are entered as straight decimal numbers via Hex switches.

5. Commands 80 through 87 must be followed by legal data or error light will come on.

3.9.2 RS232 Information Input

User's terminal must be set to parity inhibited (disabled), full duplex, upper case enable, 8 data bits, 1 stop bit, 8th bit set to 0.

1. To enable input of data, (CR) must be entered first, and a prompt will appear (>).

2. To set time or date, enter command followed by applicable data, eg: (CR) STH 08 (CR) or (CR) STH 8 (CR) for 8 hours.

3. To enter message, enter command followed by no more than 50 characters (including spaces), and then (CR).

4. To set and enable test number printing, enter command followed by desired number. If number is not entered, default number 00 will be printed.

5. To increment test number, enter (CR) IN (CR).

6. European format will print Day-Month-Year instead of U.S. format Month-Day-Year, and will not update for daylight savings time.

7. To use IRIG-B, serial time code must be input on pin 12 of remote connector on rear panel. Code must be unmodulated data.

Ext. Pulse Input - 3 TTL loads, minimum of 10 μsec. positive pulse width from 0-20 KHz. Stepping occurs on negative transition of pulse. 79.8 pulses/mm.

MASTER/SLAVE CONFIGURATION

2XXXS can synchronize up to 12 cascaded units. Each cable should be shielded, and should not exceed 2 feet in length.

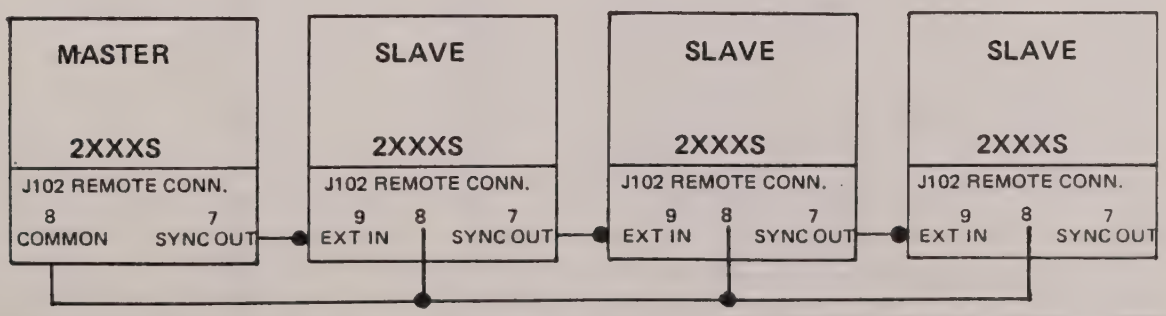


FIGURE 3-4 EXTERNAL PULSE REQUIREMENTS

8. Baud rates on terminal and annotation board must be matched. Factory-set baud rate on annotation board is 300. See Figure 3-3 Internal Control DIP Switch to Select Another Baud.

9. To check status of annotation settings, "CU" command will send information to user terminal.

10. Single print command will allow 1 cycle of print sequence if printing is enabled.

11. If any errors are made, user will receive error message.

12. Any mistakes on command or data input can be erased by a RUBOUT.

3.9.3 IRIG-B Operation

To allow use of IRIG-B time code information from an external source, "Enable IRIG Input" must be entered as a command. Pin 12 on the rear panel remote connector is used to enter the data.

IRIG-B time code must be in BCD format, digital TTL unmodulated.

3.9.4 External Trigger

Pin 13 on the rear panel remote connector can be used for the external trigger time storage feature. When pulled low, will cause hex switches to be operated on, providing the same function as the "SEND DATA" button.

To use the external trigger feature with the 8-Channel Waveform system, Model Number 896642 Chart Speed Control Cable Assembly must be used to connect the recorder REMOTE with the Waveform box.

TABLE 3-2 CONTROL CHARACTER MNEMONICS

Manual (Hex)	RS232	Description
00	NUL	Waveform time storage trigger
0D	CR	Carriage Return
80	STH	Set Hours
81	STM	Set Minutes
82	STS	Set Seconds
83	SDM	Set Months
84	SDD	Set Day
85	SDY	Set Year
86	EM	Enter User Message
87	TN	Set and Enable test number printing
88	PD	Enable date printing
89	PT	Enable time printing
8A	PS	Enable chart speed printing
8B	PM	Enable user message printing
8C	DD	Disable date printing
8D	DT	Disable time printing
8E	DS	Disable chart speed printing
8F	DM	Disable user message printing
90	EA	Enable annotation
91	DA	Disable annotation
92	TE	Enable date, time, speed and message
93	TD	Disable date, time, speed and message
96	US	Disable European format
97	IN	Increment test number
98	DN	Disable test number printing
99	IR	Enable IRIG input
9A	RT	Enable real time clock
9B	EX	Enable external trigger single print
9C	EU	Enable European format
9D	CU	Print data on user terminal
9E	DU	Enable direct data printing

TABLE 3-3 HEX CODE CHART (ASCII)
(Only used in User Message Mode)

Numbers & Symbols				Upper Case Characters			
ASCII Symbol	Manual Hex	ASCII Symbol	Manual Hex	ASCII Character	Manual Hex	ASCII Character	Manual Hex
SP (Space)	20	0	30	@	40	P	50
!	21	1	31	A	41	Q	51
"	22	2	32	B	42	R	52
#	23	3	33	C	43	S	53
$	24	4	34	D	44	T	54
%	25	5	35	E	45	U	55
&	26	6	36	F	46	V	56
'	27	7	37	G	47	W	57
(	28	8	38	H	48	X	58
)	29	9	39	I	49	Y	59
*	2A	:	3A	J	4A	Z	5A
+	2B	;	3B	K	4B	[	5B
,	2C	<	3C	L	4C	\	5C
-	2D	=	3D	M	4D	]	5D
.	2E	>	3E	N	4E	^	5E
/	2F	?	3F	O	4F	_	5F
						Rubout (Delete)	7F

TABLE 3-4 SIGNAL INPUTS FOR REMOTE OPERATION J102

PIN NO.	SIGNAL NAME	DESCRIPTION Note: Control inputs are tied to logic 1 (5V) internally)
1	$\overline{\text{STOP}}$	0 = Stop, 1 = Go. Same function as remote start/stop link on TB-101, terminals 3 & 4.
2	$\overline{\text{S3}}$	See Table 3-5 for Remote
3	$\overline{\text{S2}}$	Speed Select Bits speed
4	$\overline{\text{S1}}$	Assignments
5	$\overline{\text{S4}}$	
6	$\overline{\text{ENABLE}}$	0 = Remote (pin 6 tied to pin 8). Enables remote speed select bits, pins 2 thru 5. 0 = TTL voltage of ground or 0V. 1 = TTL voltage of 5V (or switch open) gives local control (recorder front panel controls).
7	REMOTE SYNC	Output pulse with each motor step. Used to slave another recorder to Master.
8	COMMON	Logic 0
9	$\overline{\text{EXT}}$	External pulse for step per pulse operation. (See Fig. 3-4).
10	X100	Defeats - 100 button on front panel. Active only in local mode.
12	IRIG-B	Used with optional Annotation unmodulated digital TTL BCD format time code input.
13	EX TRIG	Used with optional Annotation, when pulled low stores and prints real time the event occurred. Remains in memory and continues to print until another event occurs.

TABLE 3-5 REMOTE CONTROL PIN SPEED ASSIGNMENTS

SIGNAL NAME				SPEED
S1	S2	S3	S4	
0	0	0	0	200mm/sec
0	0	0	1	100mm/sec
0	0	1	0	50mm/sec
0	0	1	1	25mm/sec
0	1	0	0	External Pulse
0	1	0	1	10mm/sec
0	1	1	0	5mm/sec
0	1	1	1	STOP - Stops all speeds
1	0	0	0	2mm/sec
1	0	0	1	1mm/sec
1	0	1	0	.5mm/sec
1	0	1	1	.25mm/sec
1	1	0	0	External Pulse
1	1	0	1	.1mm/sec
1	1	1	0	.05mm/sec
1	1	1	1	STOP

NOTE: Remote Control Operation, overrides all Front Panel Controls except for the power ON/OFF pushbutton.

TABLE 3-6 RS232C CONNECTOR PIN NUMBERS J103

PIN NO.	SIGNAL NAME	DESCRIPTION
2	TXD	Serial data signal from recorder to user.
3	RXD	Serial data signal from user to recorder.
7	COMM	Signal Common.
21	+5V	Supply Voltage

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